Networking Research Testbeds (NRT) Program

National Science Foundation
Division of Advanced Networking Infrastructure and Research

Full Proposal Deadline(s) (due by 5 p.m proposer's local time):

May 08, 2003

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Networking Research Testbeds (NRT) Program

Synopsis of Program:

The Networking Research Testbeds (NRT) program will create a new generation of networking technologies through the process of ideation, realization and experimentation carried out on a diverse set of research testbeds.   Through this program, researchers will be able to test and refine new concepts and architectures on a number of independent testbeds that have been designed and built by networking researchers themselves. While all NRT's will emphasize cutting-edge research, each individual testbed will be designed to support activities in a defined thrust area. NRT's can therefore range in size from small campus-size testbeds to larger regional or national-scale testbeds, depending on the level of collaboration, partnership and the project mission. The underlying platform may be based on different technology components -such as wireless, fiber-optic or overlay networks - depending on the level of flexibility and control required by the associated research program. We encourage collaborative projects with highly ambitious goals and pioneering visions that step outside today's Internet-centric paradigm. Projects must contribute in a significant way to expanding the frontiers of networking through exploration of new theories and architectures, and development and testing of prototype systems.

ANIR has a companion program announcement called the Experimental Infrastructure Network (EIN) which emphasizes demonstrating advanced applications on next-generation networking infrastructure. Since EIN and NRT programs cover a wide, continuous problem space from experimental infrastructure to advanced networking research, the programs are being announced at the same time. Proposers will be expected to direct their proposal to either EIN or NRT, as the same proposal will not be reviewed by both programs. Proposers can, however, submit a proposal to each program if they are substantially different from each other and address the goals and objectives of the program announcement.

Cognizant Program Officer(s):

- Mari W. Maeda, Program Director, Directorate for Computer & Information Science & Engineering, Division of Advanced Networking Infrastructure and Research, 1175 N, telephone: (703) 292-8949, fax: (703) 292-9010, email: mmaeda@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.070 --- Computer and Information Science and Engineering

Eligibility Information

- **Organization Limit:** None Specified.
- **PI Eligibility Limit:** None Specified.
- **Limit on Number of Proposals:** None Specified.

Award Information

- **Anticipated Type of Award:** Standard or Continuing Grant or Cooperative Agreement
- **Estimated Number of Awards:** 4 to 8
- **Anticipated Funding Amount:** $10,000,000 subject to the availability of funds in FY 2003.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Full Proposal Preparation Instructions:** Standard GPG Guidelines apply.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required.
- **Indirect Cost (F&A) Limitations:** Not Applicable.
- **Other Budgetary Limitations:** Not Applicable.

C. Due Dates

- **Full Proposal Deadline Date(s)** (due by 5 p.m proposer's local time):
     May 08, 2003

Proposal Review Information

- **Merit Review Criteria:** National Science Board approved criteria apply.

Award Administration Information

- **Award Conditions:** Standard NSF award conditions apply.
- **Reporting Requirements:** Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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Summary of Program Requirements

I. INTRODUCTION

Advances in computer networking, fueled by decades of networking research, have had an enormous and profound impact on our society and have been identified as a key engine for economic growth in the next century. The growing capabilities and ever-decreasing cost of computation and communications hardware are enabling a new generation of highly heterogeneous and dynamic networks that are fundamentally very different from today's networks. Demanding applications - arising in diverse areas such as scientific research and homeland security - pose especially exciting challenges that cannot be met by existing techniques. Projects are sought that make bold assumptions about the future, and explore significantly new approaches that can lead to realizing the full potential of distributed applications and future networks in 2010 and beyond. Funding is available to support collaborative projects which push the frontiers of networking research using NRT's.

II. PROGRAM DESCRIPTION

Historically, testbeds have played a pivotal role in the advancement of networking research, accelerating the progression from early-concept design and early prototyping to broader deployment and operational insertion. The classic example is the creation and the evolution of ARPANET which enabled testing and validation of early packet switching concepts. More recent successes have proven that testbeds can bring a powerful focus to research and offer a proving ground for ground-breaking new ideas. Testbeds have also proven to be an invaluable educational vehicle not only for training a new generation of experimental systems researchers but for exposing undergraduate and graduate students to a more multi-disciplinary approach needed to advance technologies beyond purely conceptual research.

While there are many forms of successful research testbeds, they can often be classified into two broad groups:

1. **proof-of-concept testbeds** that are built as a result of intense, focused effort in design, prototyping and integration to prove out a particular new networking architecture and system, and

2. **shared facility testbeds** that offer common, open resources to a broad community of networking researchers.

The emphasis of the proof-of-concept testbeds is on the ***design and prototyping phase*** to which ample resources and time must be devoted, especially when new hardware systems are involved. In such testbeds, most of the research is accomplished once the testbed is built, tested and demonstrated. On the other hand, the focus of the shared facility testbeds is on ***operating and enhancing*** an experimental facility that has maximum utility for a broad research community. Users of the shared-facility testbed are not necessarily the designers or operators of the testbed, hence care must be taken to make available needed resources, to expose appropriate API's, and to maximize ease-of-use. Both types of testbeds with their distinct missions are recognized as being vital to the program.

Depending on the research objectives, the testbeds can range in size and geographic extent and may employ a wide range of underlying technologies. However, the NRT projects will have several characteristics in common:

- Focus on networking technologies that are 5-10 years out (e.g. what will the network of 2010-2015 look like and need)

- Full control of the testbed infrastructure by networking researchers (both design and management)
- Collaborative partnership of cross-disciplinary researchers and/or multi-organization teams.
- Project plan that emphasizes active research coordination .

While a careful distinction is drawn between networking research testbeds and networks that are engineered to support advanced applications, some applications can indeed be a powerful motivator for networking research. Certain applications in support of scientific experimentation and in the national security domain pose especially compelling challenges that cannot be met with incremental advances. And, if the research meets its objectives, what may appear in the near term to be a special-purpose networking technology may turn out to have a huge, far-reaching societal impact in the future. Hence, proposals are encouraged to identify, where appropriate, stressing applications and driving scenarios for the innovations and to describe what new capabilities are potentially enabled by the proposed research.

There are many networking areas that will benefit from testbed research activities. These areas include new security mechanisms, service-oriented overlay networks, and dynamically extensible networks.   The program strongly encourages research that addresses the limitations of traditional layering structure and the IP-centric framework, and explores radically new architectures that integrate advances in physical device technologies. Examples in this arena include: alternative architectures, systems and protocols for future optical networks; wireless networks based on spectrum sharing; distributed sensor networks; and networking in highly dynamic and/or harsh environments. Proposals are not limited to the areas described above, and alternative visions are encouraged. However, it is emphasized that the proposed research must target ambitious, long-term goals; specifically excluded is research that only results in evolutionary improvement to the current state of practice.

We stress that the proposers must specifically address the two National Science Board approved merit review criteria within the Project Summary (see Proposal Review Information Section below). We also strongly encourage proposers to address the following questions in the summary and the body of the proposal with minimum use of jargon:

What is the problem being solved?

What are the limitations of current practices?

What are the metrics for measuring success in the new proposed approach?

What are the milestones and deliverables for the project?

What are the roles of different collaborators and how are their outputs integrated at different time-points of the project?

We also encourage the development of educational and learning opportunities for undergraduate and graduate students to participate in NRT projects. These opportunities may include a range of activities such as seminars and workshops, participation in research and experiments, internships and so forth.

A separate new program announcement - Experimental Infrastructure Network (EIN) program - solicits projects that focus on high-performance infrastructure and new applications. Since the EIN and the NRT programs cover a wide, continuous problem space from experimental infrastructure to advanced networking research, they are being announced and issued at the same time. Proposers will be expected to direct their proposal to either EIN or NRT, as the same proposal will not be reviewed by both programs. Proposers can, however, submit a proposal to each program if they are substantially different from each other and address the goals and objectives of the program announcement. Proposers are encouraged to contact the appropriate Program Director if they are unsure which program they should submit to or if they have any questions.

For additional background information on NRT program, see the final reports from NSF workshops:

"Report of NSF Workshop on Network Research Testbeds", URL: http://gaia.cs.umass.edu/testbed_workshop

"Network Research and Testbeds Workshop Report", URL: http://lids.mit.edu/workgroups/nsf/

III. ELIGIBILITY INFORMATION

The categories of proposers identified in the Grant Proposal Guide are eligible to submit proposals under this program announcement/solicitation.

IV. AWARD INFORMATION

The anticipated program funding is $10,000,000 in FY 2003 and awards may be made as standard or continuing grants or cooperative agreements. The final program budget, number of awards and average award size or duration are subject to the availability of funds. Individual project duration will typically be for three to four years.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Instructions:

Proposals submitted in response to this program announcement/solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF *Grant Proposal Guide* (GPG). The complete text of the GPG is available electronically on the NSF Website at: http://www.nsf.gov/cgi-bin/getpub?gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

Proposers are reminded to identify the program announcement/solicitation number (03-538) in the program announcement/solicitation block on the NSF *Cover Sheet For Proposal to the National Science Foundation*. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

Cost Sharing:

Cost sharing is not required in proposals submitted under this Program Solicitation.

C. Due Dates

Proposals must be submitted by the following date(s):

Full Proposal Deadline(s) (due by 5 p.m proposer's local time):

   May 08, 2003

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this announcement/solicitation through the FastLane system. Detailed instructions for proposal preparation and submission via FastLane are available at: http://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program announcement/solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this announcement/solicitation.

Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Proposers are no longer required to provide a paper copy of the signed Proposal Cover Sheet to NSF. Further instructions regarding this process are available on the FastLane Website at: http://www.fastlane.nsf.gov

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest, at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

The National Science Board approved revised criteria for evaluating proposals at its meeting on March 28, 1997 (NSB 97-72). All NSF proposals are evaluated through use of the two merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

On July 8, 2002, the NSF Director issued Important Notice 127, Implementation of new Grant Proposal Guide Requirements Related to the Broader Impacts Criterion. This Important Notice reinforces the importance of addressing both criteria in the preparation and review of all proposals submitted to NSF. NSF continues to strengthen its internal processes to ensure that both of the merit review criteria are addressed when making funding decisions.

In an effort to increase compliance with these requirements, the January 2002 issuance of the GPG incorporated revised proposal preparation guidelines relating to the development of the Project Summary and Project Description. Chapter II of the GPG specifies that Principal Investigators (PIs) must address both merit review criteria in separate statements within the one-page Project Summary. This chapter also reiterates that broader impacts resulting from the proposed project must be addressed in the Project Description and described as an integral part of the narrative.

Effective October 1, 2002, NSF will return without review proposals that do not separately address both merit review criteria within the Project Summary. It is believed that these changes to NSF proposal preparation and processing guidelines will more clearly articulate the importance of broader impacts to NSF-funded projects.

The two National Science Board approved merit review criteria are listed below (see the Grant Proposal Guide Chapter III.A for further information). The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which he/she is qualified to make judgments.

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

NSF staff will give careful consideration to the following in making funding decisions:

Integration of Research and Education
One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by Ad Hoc and/or panel review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the date of receipt. The interval ends when the Division Director accepts the Program Officer's recommendation.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program Division administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See section VI.A. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (NSF-GC-1); * or Federal Demonstration Partnership (FDP) Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreement awards also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/home/grants/grants_gac.htm. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/cgi-bin/getpub?gpm. The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Website at http://www.gpo.gov.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the PI must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period.

Project reviews will take place several times a year in the form of PI meetings and site-visits.

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for the PI and all Co-PIs. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project reporting system, available through FastLane, for preparation and submission of annual and final project reports. This system permits electronic submission and updating of project reports, including information on project participants (individual and organizational), activities and findings, publications, and other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system.

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding this program should be made to:

- Mari W. Maeda, Program Director, Directorate for Computer & Information Science & Engineering, Division of Advanced Networking Infrastructure and Research, 1175 N, telephone: (703) 292-8949, fax: (703) 292-9010, email: mmaeda@nsf.gov

For questions related to the use of FastLane, contact:

- Priscilla L. Bezdek, Program and Technology Specialist, Directorate for Computer & Information Science & Engineering, Division of Advanced Networking Infrastructure and Research, 1175 N, telephone: (703) 292-8950, fax: (703) 292-9010, email: pbezdek@nsf.gov

IX. OTHER PROGRAMS OF INTEREST

The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at http://www.nsf.gov/cgi-bin/getpub?gp. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF E-Bulletin, which is updated daily on the NSF Website at http://www.nsf.gov/home/ebulletin, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's Custom News Service (http://www.nsf.gov/home/cns/start.htm) to be notified of new funding opportunities that become available.

Proposals concerning Networking Research Testbeds that are submitted to NSF-wide programs such as Information Technology Research and CAREER programs, as well as those that can be considered for EPSCOR funding, should designate CISE/ANIR NRT as a related program area.

NRT program operates in close partnership with Experimental Infrastructure Networks (EIN), Special Projects in Networking (SPN), and Strategic Technologies for the Internet (STI) programs in CISE/ANIR.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete fully in its programs. In accordance with Federal statutes, regulations and NSF policies, no person on grounds of race, color, age, sex, national origin or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF, although some programs may have special requirements that limit eligibility.

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See

the GPG Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at http://www.nsf.gov

- **Location:**   4201 Wilson Blvd. Arlington, VA 22230

- **For General Information**   (703) 292-5111
  (NSF Information Center)**:**

- **TDD (for the hearing-impaired):**   (703) 292-5090 or (800) 281-8749

- **To Order Publications or Forms:**

        Send an e-mail to: pubs@nsf.gov

               or telephone: (703) 292-7827

- **To Locate NSF Employees:**   (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to applicant institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies needing information as part of the review process or in order to coordinate programs; and to another Federal agency, court or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to an information collection unless it displays a valid OMB control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Division of Administrative Services, National Science Foundation, Arlington, VA 22230.

OMB control number: 3145-0058.

The National Science Foundation
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